SAFETY DEVICE FOR A MOTOR VEHICLE COMPRISING A FRONT-END STRUCTURE

The invention relates to a safety device for a motor vehicle comprising a front-end structure, a front bulkhead, which separates the front-end structure from an interior, and a brake apparatus fixed to the front bulkhead and comprising a brake cylinder.

From the prior art according to DE 198 39 521 C1, a safety device for a motor vehicle comprising a front-end structure and a front bulkhead, which separates the front-end structure from an interior, is known. Fixed to the known front bulkhead is a brake apparatus comprising a brake cylinder. In the front end, furthermore, on the body shell structure, mechanical forced guidance means are provided, which interact with a supporting attachment disposed on a brake cylinder of the brake apparatus. In the event of a vehicle crash in which the front end is deformed, the mechanical forced guidance means is displaced in the direction of the brake apparatus. If the deformation is great enough, the mechanical forced guidance means acts upon the supporting flange on the brake cylinder and brings about a purposeful pivot motion of the brake apparatus. The brake apparatus is connected to brake pedals protruding into the interior. Through the pivoting of the brake apparatus, the brake pedals are swung out of the foot well.

It is additionally known from the prior art to provide structural elements and assemblies disposed in the front-end structure, such as, for example, an engine, with special forced guidance means assigned to the brake apparatus. To this end, reference is made, for example, to JP 10-338 167 A1. From this prior art, it is also known to provide the brake

cylinder of a brake apparatus with means for pivoting the brake apparatus, which means, in the event of a vehicle crash, interact with structural elements disposed in the front-end structure.

The object of the present invention is to provide a safety device for a motor vehicle comprising a front-end structure, a front bulkhead, and a brake apparatus fixed to the front bulkhead, by means of which the injury risk for a driver of the motor vehicle in the foot region is reduced by simple means in the event of a vehicle crash.

This object is achieved by a safety device for a motor vehicle having the features of patent claim 1.

Accordingly, the invention is distinguished by a brake apparatus fixed to the front bulkhead and having a brake cylinder, the brake cylinder having means for pivoting the brake apparatus which have a fastening portion and a slide portion with a slide plane. By means of the fastening portion, the slide portion can be easily connected to the brake cylinder. In the event of a vehicle crash in which the front-end structure is deformed, the slide plane interacts with structural elements disposed in the front-end structure. Through suitable alignment of the slide plane, the interaction of these structural elements disposed in the front end brings about a tilting motion of the brake apparatus. This tilting motion causes the pedals connected to the brake apparatus and protruding into the interior to swing out. An injury risk for the driver of the vehicle in the foot region is thereby reduced.

It is conceivable that the means for pivoting the brake apparatus are assigned to the, in the direction of travel, forward-pointing end face of the brake cylinder. As a result,

the slide portion protrudes relatively far into the front-end structure, whereby the brake apparatus plays an early part in deforming the front-end structure through the previously described tilting motion. As a result of this early involvement in the front-end deformation, the brake apparatus can cover relatively large swivel angles, allowing the brake pedal to be reliably swung out from the foot well.

The means for pivoting the brake apparatus can be detachably connected to the main brake cylinder. This yields the advantage that different peaks can be provided according to vehicle model or depending on whether the model in question is a right-hand or left-hand drive. In addition, it allows already installed brake apparatuses to be easily upgraded. Added to this is the fact that, in the case of a multipart construction, there is a free choice of material, so that the material for the means for pivoting the brake apparatus can be chosen independently from the material for the brake cylinder. Of course, it is also conceivable to realize the means for pivoting the brake apparatus in one part with the brake cylinder, which, in turn, yields benefits in terms of manufacturing costs, since, in place of two separate structural elements, a single structural element needs to be made.

The slide plane can be aligned such that the brake apparatus, in the event of a vehicle crash, performs a swivel motion about a substantially horizontal axis. This swivel motion ensures that the brake pedal can be reliably swung out from the foot well of the interior of the motor vehicle.

The slide portion can consist of four faces arranged in a certain manner one relative to the other, one face of which forms the slide plane. These faces can here enclose a cavity. This arrangement yields the advantage, in comparison to solid

structural elements, of lower weight. Through the use of a plurality of faces, the stability of the structural element is considerably increased. The four faces can be arranged, for example, such that, in a longitudinal section in the vertical direction of the vehicle, they have a triangular cross section, one corner of which is aligned downward.

It is conceivable that at least one of the faces of the slide portion has a downwardly increasing wall thickness. This embodiment can be conditioned by production engineering factors if the slide portion, for example, is realized as a casting. It also, however, yields additional advantages with respect to the stability, particularly of the slide plane.

In the cavity, means can be provided for the drainage of liquids, such as, for example, a discharge opening. This yields the advantage that, for example, cleaning agents used in an engine wash, which might have collected in the cavity, can easily run away.

The fastening portion of the means for pivoting the brake apparatus can have receiving fixtures for fastening means, such as bores, for example. By way of these bores, a connection between the means for pivoting the brake apparatus and the brake cylinder is able to be established in a particularly cheap and simple manner by means of fastening means.

The invention will be explained in greater detail below with reference to the illustrative embodiment represented in the drawings, in which:

Fig. 1 shows a diagrammatic side view of the inventive embodiment of a safety device for a motor vehicle comprising a front-end structure,

Fig. 2 shows a three-dimensional representation of the means according to the invention for pivoting a brake apparatus,

Fig. 3 shows a side view of the means according to Figure 2 from the side facing toward a brake cylinder,

Fig. 4 shows a side view of the means according to Figure 2 from the side facing away from the brake cylinder,

Fig. 5 shows a top view of the means according to Figure 2.

A passenger vehicle has, in a manner which is fundamentally known, a front-end structure 1 (not fully represented in Figure 1) which has as body shell parts, inter alia, two front-end longitudinal members 2 and, for each vehicle side, respectively a spring strut bracket 3 or a wheel housing. The front-end longitudinal members 2 merge into a front bulkhead 4, which forms the termination of the front-end structure 1 in the direction of the passenger compartment and the vehicle interior. Protruding into a foot well 5 of the vehicle interior, in a manner which is fundamentally known, is a brake pedal 7, which is coupled to a brake apparatus 6. The brake apparatus 6 is fixed to the front bulkhead 4.

The front-end structure 1 bounds a front-end space, which in vehicles with a front engine constitutes an engine compartment and in vehicles with rear engine or in vehicles with a centrally placed engine constitutes a trunk or loading space.

The brake apparatus 6 is fixed to the front bulkhead 4 in such a way that a brake booster 8 is located on that side of the front bulkhead 4 which faces toward the front-end space, i.e. the engine compartment or the trunk or loading space. To the front in the longitudinal direction of the vehicle, the brake booster 8 is adjoined by a main brake cylinder 9, which is likewise part of the brake apparatus 6. Above the main brake

cylinder 9, a pressure medium reservoir 10 can be placed in a manner which is known per se.

In a front end face region of the brake apparatus 6, in the represented illustrative embodiment in a front end face region of the brake cylinder 9, a means 11 for pivoting the brake apparatus 6 is provided on a housing of the brake cylinder 9. This means 11 is described in greater detail below with reference to Figures 2 to 5.

In Figure 2, a means 11 for pivoting the brake apparatus 6 is represented in perspective view. The means 11 has a fastening portion 12 and a slide portion 13. The fastening portion 12 consists of two faces 14 and 15, aligned substantially at right angles to each other. In the face 15 there are made two bores 16 for the reception of fastening means.

The slide portion 13 consists of four faces 14, 17, 18 and 19. The face 19 is arranged in extension of the face 15 of the fastening portion and forms a slide plane. The face 14 corresponds to the face 14 to be assigned to the fastening portion 12. The face 18 is arranged parallel to the face 14. Extending between these two faces is the face 17. The faces 14, 17, 18 and 19 enclose a cavity 20. This cavity 20 has a triangular cross section, one corner of which borders on the fastening portion 12, in particular on the face 15 thereof. In the installed state, the means 11 for pivoting the brake apparatus is arranged such that the slide plane 19 points forward in the direction of travel, the face 17 is assigned to the brake cylinder 9. The means 11 are connected by the fastening portion 12 to the brake cylinder 9. The cavity 20 is thus open to the top.

In Figure 3, the means 11 is represented in a side view of the face 17 assigned to the brake cylinder. In addition, the two

mutually parallel faces 14 and 18, and the face 19 projecting over the face 17, are discernible. The lower termination of the means 11 is formed by the face 15.

In Figure 4, the means 11 is represented in a side view of the slide plane 19. In addition to the face 19, the face 15 is discernible, which forms the lower termination of the means 11 and projects laterally over the face 19. In addition, an end opening 21 is discernible. This end opening 21 is realized as a bore which passes through the face 19. The end opening 21 ensures that liquids received in the cavity 20 are able to run away.

Figure 5 shows a top view of the means 11. Located in the plane of the drawing is the face 15 with the two bores 16. Extending perpendicular to the plane of the drawing are the faces 14, 18 and 17. Extending obliquely to the plane of the drawing, which is not apparent, however, in this representation, is the slide plane 19. In the slide plane 19, the discharge opening 21 is also identifiable.

It is apparent from Figure 5 that the wall thicknesses of the faces 14, 17 and 18 increase in the downward direction. Their thickness can measure, for example, 4 mm in the upper region and 7 mm in the lower region. The slide plane 19 can be realized correspondingly. With a 7 mm thick face 15 containing the bores 16, it is possible to produce a sufficiently rigid structural element. The means 11 can be realized, for example, as a casting. In this case, the distribution of the structural element thickness is conditioned by production engineering factors.

The modus operandi of the safety device according to the invention for a motor vehicle having a front-end structure is described below. In the event of a vehicle crash, the front-

end structure 1 is deformed in such a way that the front-end longitudinal member 2 and the spring strut bracket move in the direction of the front bulkhead. Structural elements disposed in the front-end structure are thereby moved likewise in the direction of the front bulkhead. When the deformation is sufficiently large, the moment is sometime reached at which the brake apparatus 6 collides, with the forward-pointing slide plane 19, with structural elements disposed in the front-end structure. Due to the alignment of the slide plane 19, the brake apparatus 6 is rotated about a substantially horizontal swivel axis. The brake apparatus 6 thus undergoes a tilting motion. The tilting motion, as shown in the representation according to Figure 1, is realized in the clockwise direction. Through this tilting motion of the brake apparatus 6, the brake pedal 7 coupled to the brake apparatus 6 is moved out of the foot well 5 forward in the direction of travel, so that injury risks for the foot region of the driver are reduced.

In order to prevent the possibility that further buckling of the front-end structure in the longitudinal direction of the vehicle in connection with the front-end deformation during the vehicle crash might lead to rearward displacement of the brake apparatus 6, inclusive of the brake pedal 7, toward the foot well 5, the slide plane 19 can be designed such that, from a certain swivel angle of the brake apparatus 6 relative to the front bulkhead 4, it slides off from the structural element disposed in the front-end structure and with which it interacts, with the result that no further torque is applied to the brake apparatus 6. This ensures that the desired swiveled-back position of the brake pedal 7 is maintained and that the brake apparatus 6 no longer leads to any further rearward displacement of the brake apparatus 6 resulting from a further deformation of the front-end region.

Of course, it is also conceivable to realize the means 11 for pivoting the brake apparatus 6 in one piece with the brake cylinder. Similarly, fastening means present in the brake cylinder, such as, for example, a closing screw, can be designed such that they have a slide portion 13 having a slide plane 19.